Results Of Vegetable Research At The Eastern Regional Research Laboratory

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Studies on vegetables at this Laboratory included a survey of the carotene (provitamin A) and the riboflavin (vitamin B_2) contents of some 80 vegetables, their availability as packing house or cannery wastes, and the extraction of carotene from dried vegetable leaf wastes. A report of this survey was made at the Vegetable Growers' Association meeting in Pittsburgh in December 1942.[2] Since then work has been done mainly on the extraction of carotene from leaf wastes and the use of vegetable wastes as animal feeds.

The carotene-extraction procedure is largely chemical. Briefly, certain vegetable leaf wastes, when concentrated by separation of the leaf blades from the stems, contain large proportions of carotene, which can be extracted with organic solvents. Methods have been devised for the efficient and economical removal of the green plant pigment, chlorophyll, and the yellow-orange pigment, xanthophyll, from the extracts. The process is now ready for the pilot plant, and the equipment is being assembled as rapidly as possible.

The carotene and riboflavin contents of certain vegetable leaf wastes indicated that they might be good sources of these vitamins for animal and poultry feed mixtures. Furthermore, most of them were surprisingly high in protein. Accordingly, from the 80 different vegetables we picked 13 of the most promising for more detailed study. These were all leafy tissues which could be dried and prepared in the form of leaf meal concentrates of rather high nutritive value. A brief article in "Feedstuffs"[3] last spring called attention to their possibilities.

Since the feed concentrates were intended for poultry mixtures to supplement the diminished supplies of good alfalfa leaf meal, one of our major aims was to prepare meals with low crude fiber content. This has been accomplished by a relatively simple procedure, which we believe has commercial possibilities. In drying leaf wastes the thin leaf blade becomes brittle before the thicker, tougher stem does. By removing the material from the dryers at the stage when the leaf blades were brittle and tumbling it in a rotary screen with stones, a high-grade leaf meal can be separated effectively from low-grade stem material.

About 2 tons of various leaf meal concentrates were prepared during the past season by our Engineering Division. Considerable data

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[2] Annual Report, Vegetable Growers' Association of America, 1942, pp. 62-68.

[3] Feedstuffs, vol. 15, no. 26, pp. 18-21, June 26, 1943.

were obtained on the drying characteristics of the various vegetable wastes.

Again this year we have had splendid cooperation from the vegetable growers in giving us fresh vegetable wastes for drying. King Farms Company and Starkey Farms Company of Morrisville, Pennsylvania, and Seabrook Farms of Bridgeton, New Jersey, have been particularly kind.

On October 19 the first lot of dried leaf meals was sent to the Delaware Agricultural Experiment Station where the Director, G. L. Schuster, and A. E. Tomhave of the station staff had worked out a program to test the meals on growing chicks. In the first experiment 1400 1-day-old chicks were fed an 8 per cent level of leaf meal in the mixed ration in place of 8 per cent of alfalfa. An alfalfa control and a negative control, consisting of the mixed ration without alfalfa or leaf meals, were tested simultaneously. Leaf meals from pea vines, lima bean vines, carrot tops, broccoli, and turnip tops were used. This experiment is still not complete, but we have made a number of interesting observations.

All of the leaf meals tested appear to supply factors similar to those found in alfalfa. The growth of chicks was the same when fed alfalfa, limabean, carrot, or turnip leaf meals. Growth was definitely better with broccoli but not quite so good with pea vines. The latter result was expected, since the drying procedure used during the early part of the summer scorched the material, with consequent loss of nutritive value.

We had expected that the chickens would not like the broccoli leaf meal, because of its strong odor or taste, but they did, and from the start of the experiment they grew more rapidly on it than on any of the other meals. The shanks of the broccoli-fed birds, particularly, were so yellow they could not be estimated on the average color scale, and a new chart had to be used. Since good shank color is desirable in broilers in some parts of the country, this pigmentation factor should be a good sales point.

The young chicks did not relish the turnip leaf meal mixture, but after a month they no longer objected to it and subsequently gained weight rapidly enough to equal and even surpass the alfalfa-fed chicks.

These experiments indicate that in a high a concentration as 8 per cent the leaf meals are palatable, are lacking in any toxic factors, and have the factors necessary for good healthy growth.

Is it practical to dry these waste products for feeds? We do not have the complete answer to that question yet; only commercial experience will give the final answer. It is understandable that the vegetable grower will want to obtain as high a price as possible for his wastes; otherwise why be bothered with any changes? The consumer will wish to know how these vegetable leaf meals compare in

cost with alfalfa per pound of meat produced. Right now any available high-grade product is valuable because of the great need for feed supplements. We do not know what the situation will be after the war.

Feeding tests with individual meals and mixtures of the meals are to be undertaken soon to find the level of leaf meal needed for good chick growth and for good laying and hatching. Kale, spinach, and other available wastes will be dried and tested during the coming season. Beet leaf meal, also a volume product, has been prepared but remains to be tested for its feed value.

Meals from which the carotene has been extracted will be tested as feed supplements, since it is apparent that the carotene content of several of them is greatly in excess of that needed for optimum growth. Carotene concentrates of various degrees of purity are also being prepared for feed supplements. Both a petroleum ether extracted broccoli meal and the concentrated extract will be tested on the same groups of chicks.

Eventually we shall study the economics of growing crops such as broccoli, kale, and turnip tops for feed purposes. The leaf meals from these crops are so high in vitamin factors that it might prove feasible to grow them as late season crops to extend the season for a dehydrator located where it would have access to pea vines, lima bean vines, alfalfa, and the late growing vegetable crops. Mustard greens may be another good crop for this purpose since, according to Mac Gillivray's tables, it is the richest in vitamins of any of the California vegetables tested.

Please be assured we are not trying to tell the grower to change to other crops, but are only doing the research which will help him to decide whether he could benefit by such changes. The function of the vegetable research program of the Eastern Regional Research Laboratory is to show how vegetable products can be made more valuable. And at all times we hope that you vegetable growers will feel free to suggest and advise us in our work.